

ESTIMATION OF AGE FROM OLECRANON CENTRE OF THE UPPER END OF THE ULNA BY USING RADIOGRAPHS OF 6 TO 18 YEARS AGE FEMALE SUBJECTS

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Abstract

Determination of the age of an individual from the appearance and the fusion of the ossification centres is a well accepted fact in the field of medical and legal professions. A cross- sectional descriptive radiological study was carried out with the objective to estimate the age of appearance and fusion of the olecranon ossification centres of the upper end of the ulna of female subject in central Sudan. A total of 56 females aged between 6 to 18 years free of physical disabilities, nutritional and endocrine disorders were selected. A classification into five stages was applied to assess the ossification of the olecranon centre (1: Not ossified OC ; 2: Partial ossified (appearance); 3: Ossified, nonunion of the olecranon centre and shaft; 4: Partial union of the epiphysis and metaphysis; Stage 5: complete fusion of the epiphysis and metaphysis. It was established that the olecranon centre appeared at the age 8-10 years and completely fused to the shaft of ulna at the age 14-16 years. Olecranon process ossification; appearance and fusion was almost similar with other workers and the outcomes of the study can be utilized for Sudanese population.

Introduction

Age estimation in the living is one of the most important tasks especially in developing countries where birth records are often not well-maintained.¹ Determination of the age of an individual from the appearance and the fusion of the ossification centres is a well accepted fact in the field of medical and legal professions.² The areas of interest with reference to appearance and fusion of ossification centers at elbow region include lateral epicondyle with capitulum, trochlea with capitulum, conjoint with shaft and medial epicondyle with shaft of humerus, head of radius with shaft and olecranon process with shaft of ulna.³

The living age determination is the most important issue to the court and to the common citizens as well. It is essential to establish the identity of the person at the time of admission to schools, colleges, institutes, or while competing in sports tournaments at regional, state or national levels. Ossification center are seen earlier in the tropical countries and in females. The variation in the appearance and the union of ossification centers is mainly attributed to various factors like climate, heredity, race, nutrition, dietary habits, and gender and socio- economic status of population.¹

Extensive works on the estimation of age of epiphyseal union has been carried out in different parts of the world⁴ and most data of appearance and fusion of ossification centres are based on White children from the upper socio-economic level.^{5,6} The Sudan population differs widely from the western population in hereditary, dietary, socio-economic and ethnic factors and there is a considerable lack of interesting about this field, as there were no modern studies concerning about the age estimation of bones of the elbow joint. This study tried harder to put a piece of light in this field, concerning elbow bones estimation, particularly the olecranon process of the ulna.

This study aimed to find out the age of the appearance and fusion olecranon process of the upper end of the ulna at the elbow joint by using radiographs of female subject, and to compare with other studies done in the world.

Material and Methods

This cross-sectional descriptive study, was carried out at Wad Medani Orthopedic Centre and Gezira National Centre for Pediatric Surgery (GNCPS), both centres are located at the Gezira State in Central Sudan. A total of 56 females aged between 6 to 18 years old attending the outpatient departments of these centres were selected. They were from all social classes, with variable socioeconomic status and were free from any physical disability involving upper limbs, nutritional and endocrinal disorders at the time of radiography. An informed consent was taken from subjects or their care takers prior to investigation.

The x-ray films were taken and films were developed with the help of experienced technicians. Radiographs were taken by Shimadzu x-ray system and Toshiba using the following radiological specification:

1. X- ray in the right and left elbow - AP & lateral view
2. KV40-42 (centered at elbow) - mAs 3.8-4.6
3. Tube distance: 36 inches
4. Films size: B &C

The radiographs were saved electronically on a computer for analysis and were studied in detail by the radiologist with respect to appearance and fusion of ossification centre. The different phases of olecranon centre (OC) ossification and fusion to the shaft of the ulna were graded into five stages: Stage 1: Not ossified OC ; Stage 2: Partial ossified OC, appearance of OC; Stage 3: Ossified OC, (nonunion of the epiphysis and metaphysis); Stage 4: Partial fusion of OC, partial union of the epiphysis and metaphysis; Stage 5: Complete fusion, complete union of the epiphysis and metaphysis.

The ossification centres of the olecranon process were visible on radiographs and had been reported and documented.

Data Analysis: The data were coded, processed and transferred to a computer. The descriptive analysis was adopted. Software Program: SPSS was applied.

Results and observations:

The present study was undertaken to find out the age of ossification and fusion of epiphyses at the olecranon process of the upper end of the ulna in 56 females. Table (1) reveals the number of cases in each age group. Maximum number were from 12-14 age group. Age group from 6-8 is considered as that who have completed 6 and 8 years of age but not yet to complete 8 years of age and similarly for other age groups.

For age group 6-8 years radiographs of the elbow area showed that in the majority of cases (87.5%) the olecranon centre (OC) was not ossified, and it was appeared and partially ossified in one case (12.5 %).

Appearance of OC was seen in the majority of cases in age group 8-10 years and it was also seen in 30% of cases in the age group 10-12 years.

It is clear from table (1) that, ossified olecranon process without fusion to the shaft of ulna was seen in 70% and 41.7% of cases in age group 10-12 and 12-14 years respectively. Partial fusion of the olecranon process and the proximal end of the shaft of ulna was seen in 50% and 20% of the age group 12-14 and 14-16 years respectively.

Complete fusion of the olecranon process to the shaft of ulna was occurred in the majority (80%) of cases in age group 14-16 years. All cases in age group 16-18 were already completed the fusion of the olecranon process to the proximal end of the shaft of ulna.

Table (1) shows that complete fusion was seen in 17 cases of the study samples, while partial fusion was seen in 8 cases and in other 8 cases the olecranon centre was not ossified.

Table 1: Showing different stages of ossification of the olecranon centre of females in relation to different age groups.

Age group (yrs)	Sex	No. of cases	No. of cases showing various stages of ossification and fusion										Total cases	
			Stage1		Stage 2		Stage 3		Stage 4		Stage 5			
			No	%	No	%	No	%	No	%	No	%	No	%
6 - 8	F	8	7	(87.5)	1	(12.5)	-		-		-		8	(100)
8 - 10	F	8	1	(12.5)	7	(87.5)	-		-		-		8	(100)
10 - 12	F	10	-		3	(30)	7	(70)	-		-		10	(100)
12 - 14	F	12	-		-		5	(41.7)	6	(50)	1	(8.3)	12	(100)
14 -16	F	10	-		-		-		2	(20)	8	(80)	10	(100)
16 -18	F	8	-		-		-		-		8	(100)	8	(100)
No. of cases in each stage			8		11		12		8		17		56	

Table 2: Relation between the different stages of olecranon ossification and numbers of study cases

Stage of ossification of OC	No. of cases
Not ossified	8
Partial ossified	11
Ossified	12
Partial fusion	8
Complete fusion	17
Total	56

Table 3: Comparison of age of fusion of olecranon centre in females by different workers

Author	Present study		Bhise study		Glastaun study		Patel et al	Homi Mehta	Parakash
Centre of ossification	appearance (yrs)	Fusion (yrs)	appearance (yrs)	Fusion (yrs)	appearance (yrs)	Fusion (yrs)	Fusion (yrs)	Fusion (yrs)	Fusion (yrs)
Olecranon centre	8-10	14-16	9-11	14-16	6	15	15-16	13.5-15	15.5-16

Discussion

The present study about the ossification centres of the olecranon process of the upper end of the ulna at the elbow joint was undertaken to estimate the accurate ages of the appearance of this centre and its fusion to the shaft of the ulna. It was done by taking X-rays of the elbow joint in supine position either anteroposterior or lateral views and sometimes posteroanterior view. The study was conducted on 56 Sudanese girls in the age group from 6 to 18 years. They were from middle income families; the females were all healthy at the time of procedure.

The study confirmed that the mean age of complete fusion of the ossification centre of the olecranon process with the shaft of the ulna is in age of 14-16 years in 80% of females. In a similar study done by Prakash and Bansal¹, olecranon centre fuses with shaft of the ulna at the age of 15-16 years in 96% of females, in agreement with the finding of the present study. According to Galstraun⁷ study fusion occurred at the age of 14-15 yrs. Whereas Basu & Basu⁸ and Hepworth⁹ found fusion at the age of 13-14 yrs which is one to two years earlier compared to our study. Similar findings were also observed by Flecker,¹⁰ Davies & Parson.¹¹ Our finding was also nearly consistent with the study of Patel et al¹² who stated the age 15-16 years for the fusion of the olecranon to the shaft of ulna in Indian school going children. According to Davies & Parson¹¹ study fusion occurred at the age of 20 yrs which is at variance with our study, the causes being primarily attributed to geographical position and boys having been included in that study.

From this study the olecranon centre appears at 8 to 10 years (mean age 9 years) in 87.5% of females. As compared to Bhise's study in Bumbae, ossification center appearance one year earlier in our study. Bhise¹³ found that the olecranon center appearance occurred in 9-11 years in female. The discrepancy may be attributed to sample size and geographical location. From Glastaun study in Bengali girl, the olecranon centre appears at 6 year in female which is three years earlier compared to our study, the discrepancy may be attributed to exposure time, sample size, geographical location and so on.

The present study signifies that the olecranon centre in Sudanese females appear and completely fuse in the age of 8-10 and 14-16 years respectively. These observations compared with the previous studies. Comparison of observations of present study has been made with other workers^{1,7,12,13,14} with reference to age of appearance and fusion of the olecranon process in females (table 3).

More comparative studies in elbow bone age in Sudanese females are recommended to assure the present study and increasing the sample size to give more accurate result is also recommended.

Conclusion

The sequence of the olecranon process ossification; appearance and fusion was almost similar with other workers, however the range varied, which can be attributed to many among other reasons i.e. geographical variation, nutritional factors etc.

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